

HYDROLOGY

Water in the unconsolidated sediments is derived primarily from infiltration of precipitation; leakage from streams, canals, and ponds; and infiltration of irrigation water applied to lawns, gardens, and commercial crops. Downward movement of the infiltrating water is hindered by less permeable underlying bedrock, and the water accumulates to form shallow aquifers with a water table in the unconsolidated sediments (fig. 2). However, the shallow aquifers may be intermittent in upland areas. During wet seasons, or periods of intensive irrigation, large rates of infiltration can cause the water table to rise, and aquifers can form in upland areas. During dry seasons or periods of drought, a lack of infiltration can cause the water table to decline, and the unconsolidated sediments in the upland areas may be drained. The larger stream valleys are the principal areas of ground-water discharge. Ground water also is discharged from the aquifer by evapotranspiration, withdrawal from wells, and discharge to springs (Robson, 1989).

In areas directly underlain by bedrock aquifers (Robson and others, 1988), water may move between the shallow aquifers and the bedrock aquifers. Water generally moves downward from the shallow aquifers to the bedrock aquifers in upland areas and upward from the bedrock aquifers to the shallow aquifers in the larger stream valleys.

Historical water-level data for the shallow aquifers in the study area (fig. 6) show no significant water-level changes during 1978–81. This lack of change is consistent with water levels measured over a period of 30 to 60 years in other parts of the shallow aquifer system (Robson and others, 2000a, 2000b, 2000c). In the nearby areas, water levels in the shallow aquifers have remained relatively constant over many decades, and water-level declines of 5–15 feet have occurred only in local areas during a few dry periods. Following these dry periods, the water levels have recovered to near their long-term average.

The well number shown on each hydrograph in figure 6 indicates the location of the well. For example, well number IN69W-12 ABO is in Township 1 North, Range 69 West, section 12, in the southeast quarter of the northeast quarter of the northeast quarter of the section. The letter "A" indicates the northeast quarter, "B" indicates the northwest quarter, "C" if used in this example, would indicate the southwest quarter, and "D" indicates the southeast quarter. The first of the three letters indicates the largest quarterly division of the section; the following letters indicate progressively smaller quarterly divisions.

Altitude of the Water Table and Direction of Ground-Water Movement

The map of the water-table altitude (fig. 7) was prepared by hand contouring, and the geographic information system was used for plotting. Water-level measurements made in wells and test holes at various times by various individuals or agencies were hand contoured to better interpret the varied and inconsistent data values that sometimes resulted from inaccurate water-level measurements, unconsolidated sediments, mislocated data points, or fluctuating water levels. Water-table contours generally were drawn using the preponderance of data in a local area and do not necessarily agree with each individual data value. Because water-level trends are minimal and measurements were made during all seasons over many years, the map (fig. 7) represents average water-level conditions in the aquifers. At any given time, however, the water level in a well could be higher or lower than indicated on the map due to local conditions and recent effects of weather, streamflow, and irrigation.

The water table in the shallow aquifers (fig. 7) ranges in altitude from about 6,400 feet in the southwest corner of the study area to about 4,800 feet in the eastern parts of the valleys of the Little Thompson River and Saint Vrain Creek. The altitude of the water table shows water-level conditions primarily within unconsolidated sediments. However, where bedrock occurs at or near the land surface, the water table is defined by water-level conditions in the bedrock because at these locations, the bedrock aquifers generally are unconfined and have a water table similar to that in the unconsolidated sediments. The general altitude and configuration of the water table in both bedrock and unconsolidated sediments are similar to that of the land surface because depth to water is shallow in most areas. In areas where a ground-water supply has been developed, enough wells usually exist to provide water-level measurements adequate to define water-table contours at 20-foot intervals. In upland areas where sediments commonly are thin or sometimes unanated, few shallow wells exist, and water-level measurements are so sparse that the water table is contoured at 100-foot intervals. The locations of most of the upland 100-foot interval contours and some of the 20-foot interval contours are inferred from the altitude of the land surface and are shown in figure 7 as dashed lines. The thin, unconsolidated sediments may be drained during dry periods in much of the area where contour lines are dashed.

Ground water flows from areas of high water-table altitude toward areas of low water-table altitude along paths that generally are perpendicular to the water-table contours, as shown by the arrows in figure 7. Ground water flows from upland areas toward stream valleys and, toward the stream, where the larger stream valleys are principal areas of ground-water discharge. Ground water flows down the valley and toward the stream, where the water may seep into the stream. Thus, the Little Thompson River, Saint Vrain Creek, Boulder Creek, and Coal Creek all are gaining streams through most of the study area. Most of the ground water in the study area that is not withdrawn by wells or consumed by evapotranspiration eventually flows to the larger stream valleys, where it flows eastward out of the study area as streamflow or as underflow in the unconsolidated sediments.

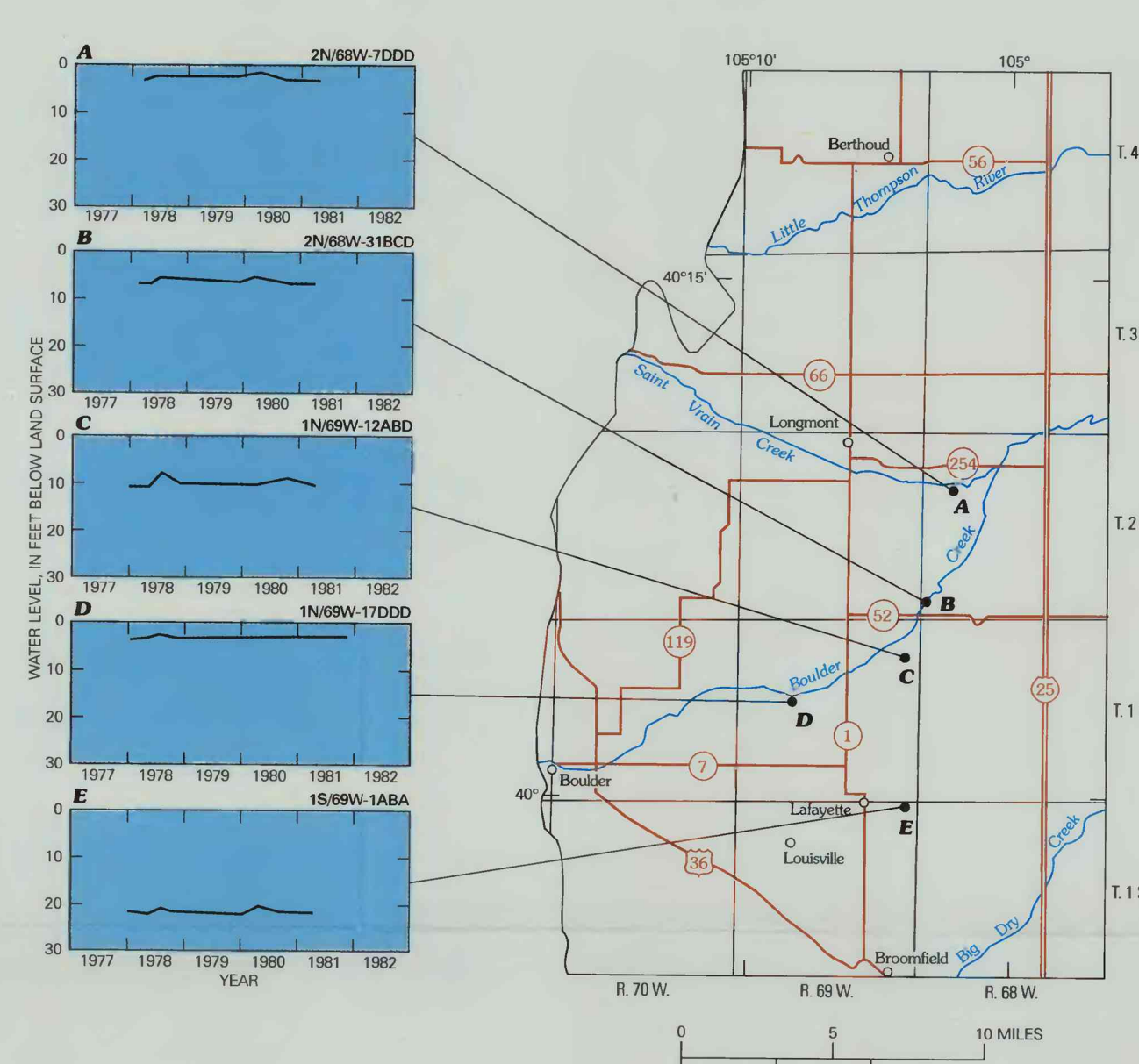


FIGURE 6—Water-level hydrographs for shallow wells.

GEOHYDROLOGY OF THE SHALLOW AQUIFERS IN THE BOULDER-LONGMONT AREA, COLORADO

By
S.G. Robson, J.S. Heiny, and L.R. Arnold
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